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Nottingham Conference

There is no ideal location for a foundrymen's conference for the simple reason that where there is ample hotel accommodation there are but few foundries and *vice versa*. In the East Midlands, there is a plethora of pre-eminent foundry concerns associated with a dearth of sleeping accommodation. However, by the exercise of commendable foresight, the whole of the six hundred delegates were successfully lodged. The Conference opened with a reception by the Lord Mayor and Lady Mayoress of Nottingham at the Council House. Such gatherings must impress upon the members the very wide appeal of the Institute, for in one corner a member on leave from India was renewing pre-war friendships; in others, delegates from allied associations in Europe were learning much of current conditions from a typical British assembly.

Mr. P. H. Wilson's presidential address contained most valuable advice, the outstanding item being addressed to H.M. Government, wherein he rightly pleaded for a sane wages policy. Until some fixed relationship is established between unskilled dockside labour and such highly skilled trades as patternmaking and moulding, no orderly progress can be made. Entries for the F. J. Cook award, prizes for which were given by the retiring president (Mr. D. Howard Webb), are reported as being both numerous and of high quality. The essays are to form the subject of a special publication. It was obvious from the applause that the Institute's major awards, presented to Dr. A. B. Everest, Mr. T. Makemson, Mr. Basil Gray, and Mr. John Bolton, were well merited; we congratulate the recipients on the well-deserved honours bestowed upon them. To characterise Sir Edward Appleton's Edward Williams' memorial lecture as being of the same standard set by earlier lecturers is indeed to accord it high praise. Sir Edward drew a fascinating picture of paths yet to be trodden by the foundry executive of the future. The cliché of " food for thought " was never more appropriately applied. The technical Papers presented gave a well-balanced programme, but one missed any contribution from the light alloy foundry section, while the heavy non-ferrous section was represented by only one paper. The Institute is not wholly to blame, for it is incumbent on those engaged in these sections of the industry to submit appropriate papers. They will be well received.

The outstanding speech at the Annual Banquet was a brilliant piece of oratory by Mr. R. B. Templeton; a few were marred by too many political allusions. Attended by some 450 participants, the function was a brilliant success. A great feature of this Conference was the facilities provided for works visits. The Stanton Ironworks Company, Limited, of which the President is deputy managing director, received the whole of the members, and last Friday a dozen concerns having a world-wide reputation for quality acted as hosts to large numbers of visitors. It is obvious that, for the organisation of so large a Conference, many months of preparation were necessary, and we are sure that every visitor felt his indebtedness to those who planned so successfully for their entertainment, and as a participant we express our cordial thanks for all that was done for us. This forty-fourth Conference will ever be remembered as providing in full measure the two essentials of a successful gathering—excellent technical material and social opportunity.

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First Post-War German Foundry Congress

The Foundry Institute of the Technical University of Aachen is staging the 11th Foundry Colloquium from July 23 to 25. The following Papers are being presented:—"Steps in the Development of High-quality Cast Iron," by E. Piwowarsky, Aachen; "The Manufacture of Cast Iron with Spherolitic Graphite Structure," by C. Adey, Burscheid; "Cast Iron and Its Properties," by G. Meyersberg, Lidingö (Sweden); "On the Alloying Technique, the Heat-treatment and the Faults of Manufacture of Cast Steel," by H. Juretzek, Witten (Ruhr); "On the Activity of the V.D.G. (German Foundrymen's Association) in the British Zone," by E. Hugo, Büderich-Düsseldorf; "The Misunderstood Mission of Modern Technology," by R. von Schöfer, Aachen; "Relations between Generator, Blast Furnace and Cupola," by H. Jungbluth, Karlsruhe; "Practical Results of the Hot-blast cupola Schaffhausen," by F. Flubacher, Schaffhausen (Switzerland); "The Influence of the Cupola Operation on Loss and Slag Regulation," by H. Jungbluth, Karlsruhe; "Foundry Mechanisation," by P. Tobias, Mannheim; "Moulding Sand Economy in Foundries," by F. Roll, Leipzig; "Design of Castings and Its Effect on Waste and Calculation," by J. H. Kuester, Köln-Deutz; "To-day's Economical Situation of German Foundries," by Th. Geilenkirchen, Düsseldorf; "Frequency-curve and Causality in Mass Production," by F. Krauss, Aachen; "On the Metallurgy and the Practice of Lead-bronze Compound Casting," by H. Mann, Papenburg; "Centrifugal Casting," by W. Geisler, Burscheid; "Foundry Technique or Powder Metallurgy? (New Ways of Shaping)," by H. Timmerbeil, Hilden; "Questions of the Crystallisation of Eutectic Aluminium-silicon Alloys," by G. Guertler, Hamburg-Altona; "Problems of Non-ferrous Metallurgy," by P. Roentgen, Aachen; "Modern Re-melting Processes of Light Metal Scrap," by A. Beck, Bitterfeld, and other Papers.

In the case of changes of programme, due to cancellation of Papers, and if the time available otherwise permits, the following Papers will be read:—"Reinforced Cast Iron," by E. Piwowarsky, Aachen; "Impact Toughness of Cast Iron," by R. Bertschinger, E.T.H. Zürich (Switzerland); "Rolling of Cast Iron," by E. Piwowarsky and A. Wittmoser, Aachen; "On the Metallurgy of Lead-bronzes for Compound-cast Friction Bearings," by F. Bollenrath, Aachen; "Black Fracture in Hydronalium Sand Casting," by E. Piwowarsky and A. Vincent, Aachen; "Grain Refinement and Deoxidation of Aluminium Alloys," by K. Wagner, Hamburg-Altona; and "The Solubility of Carbide in 12 per cent. Mn Cast Steel," by F. Roll, of Leipzig. The meeting will take place, if not announced otherwise, in the Naumann Institute, Intzestrasse 1, Aachen.

Any British technicians deciding to attend the meeting should communicate with the Foreign Office (German Section), Norfolk House, St. James's Square, London, S.W.1, for necessary permits to enter Germany, travel on military trains and make use of facilities open to British personnel in Germany.

Infra-red Heating by Gas

A small exhibition on the industrial applications and uses of infra-red heating by gas was opened on June 19 at Gas Industry House, 1, Grosvenor Place, London, S.W.1. Organised by the British Gas Council, the exhibition demonstrates one of the most recent applications of gas, that of paint curing and metal-finishing by infra-red heating tunnels. Two working models demonstrate the principle, one by Matthew Hall & Company, Limited, the other manufactured by the Ray-Heeting Company, Limited. The drying of paint on metal articles is speeded up approximately tenfold and higher in certain cases. No applications of this process to drying and skin-drying of foundry sand moulds are on show. The exhibition is open from 10 a.m. to 5 p.m. Monday to Friday, and from 10 a.m. to 12 noon on Saturday, until July 31.

New British Standards

The monthly information sheet of the British Standards Institution, of 28, Victoria Street, London, S.W.1, lists, among new standards issued, No. 1344: 1947—Methods of testing vitreous enamel finishes (2s.). This lays down standards of acid-resistant and alkali-resistant vitreous enamels and includes general methods for determination of acid and alkali resistance, ability to withstand thermal shock, heat resistance of vitreous enamelled cast iron and abrasion for the testing of vitreous enamel articles, excluding methods used for the examination of special vitreous enamel finishes for chemical or other industrial purposes.

Among new work started there are several of interest to foundrymen. These are: pearlitic and austenitic manganese steel castings; hardware for furniture; and wrought aluminium rainwater goods.

Reports on German Industry

Over 2,000 German industrial Reports are now available at H.M. Stationery Office, with some 57 on Japanese industry. The following, which were released recently, may be of interest to foundry trades:—C.I.O.S. XXXIII-59, German War List for Ferrous Materials—Appendix No. 17 to C.I.O.S. XXXII-119 (11s.); C.I.O.S. XXXIII-61, Segregation in Centrifugally-cast Gun Tubes—Appendix No. 15a to C.I.O.S. XXXII-119 (2s.); C.I.O.S. XXXIII-62, Centrifugal Casting of Crank Cases (Middle Parts)—Appendix No. 20 to C.I.O.S. XXXII-119 (3s.); B.I.O.S. 1297, Manufacture of Laboratory Chemical Reagents in Germany (5s.); B.I.O.S. 1307, Steelworks Maintenance Shops in Germany (1s. 6d.); B.I.O.S. 1347, Report on the Bothner and Voigtlander Self-centring Edging Machines (3s.); F.I.A.T. 997, German Research in the Light Metals Industry (1s. 6d.). These Reports are obtainable from any of the branch offices throughout the country, or by post direct from P.O. Box 569, London, S.E.1.

— Institute of British Foundrymen —

Annual Conference

Nottingham *June 17 to 20, 1947*

The 44th annual conference of the Institute of British Foundrymen was held on June 17, 18, 19 and 20, at the Albert Hall Institute, Nottingham. On Tuesday evening, June 17, by kind invitation of the Lord Mayor and Corporation of the City of Nottingham, the members and their ladies were accorded a civic reception at the Council House, where they were received by the Lord Mayor and Lady Mayoress (Ald. and Mrs. R. Shaw), the Sheriff (Coun. H. O. Emmony) and Mrs. Emmony. The Institute was honoured by the presence of Mr. M. Stupfler, who represented the Association Technique de Fonderie, and Mr. John Angstein, of the Czechoslovak Foundrymen's Association. Mr. D. H. Wood, the retiring President, occupied the chair.

The first business was the presentation of the annual report of the Council for the year 1946-47, which was printed in our last issue. In presenting the report and moving its adoption, the CHAIRMAN remarked that the income constituted a record. There was, on the other hand, an increase in expenditure, and in this case he hoped it would be a record for all time. The membership had now reached 3,900, and it was very pleasing to note that there had been an increase in membership in every branch and every section. The council regretted to report the death of 22 members during the year, including two former Presidents, Mr. Wesley Lambert, C.B.E., who was President of the Institute at the time of the International Conference in 1929, and Mr. Edward Williams, whose occupancy of the chair is perpetuated for all time by an annual lecture bearing his name.

Referring to the inauguration of the "Journal of the Institute of British Foundrymen," the first bi-monthly number of which was issued in November of last year, the President described this as perhaps the most important advance of the year. It was a medium for news, particularly domestic news, and the council hoped it would strengthen the ties of friendship for which the Institute had long been noted and upon which the Institute thrived. He thought the members would agree that the report was a record of achievement and progress. They should not rest on their oars, however, but should continue to pull ahead. MR. J. W. GARDOM seconded the adoption of the report, which was carried unanimously.

Finance and Technical Council's Report

In the absence of the hon. treasurer (Mr. C. W. Bigg), who was unable to be present, the accounts for the year ended December 31, 1946, were presented by the secretary, MR. T. MAKEMSON. Commenting on the material increase in income, Mr. Makemson said that was mainly due to the increase in the rate of subscription, and in part to the quite substantial increase in membership during the year. The increase in expenditure was accounted for by the general rise in costs and by the fact that they were increasing their activities and endeavouring to give more service to the members. While bearing in mind the desirability of building up a surplus, it was the general policy of the council that, as far as possible, the subscriptions should be expended for the benefit of the members. The income and expenditure account showed a surplus of income of £893, compared with £90 in the previous year. The adoption of the accounts was proposed by MR. R. B. TEMPLETON, seconded by MR. D. SHARPE, and carried.

MR. A. E. PEACE (chairman of the Technical Council), moving the adoption of the Technical Council's 15th Annual Report, drew attention to the list of publications given in the report and expressed the hope that members would make full use of them. The Technical Council would welcome comments on those publications and would like to hear from members of their experiences arising from recommendations or suggestions made in them. The "Atlas of Defects in Castings" had been most successful, there being a steady demand for it.

Their association with other societies had extended, notably with the appointment of the Joint I.B.F./B.C.I.R.A. Committee on gases in cast iron, the presentation of the Basic Cupola Committee's Report at a joint meeting with the Iron and Steel Institute and the further prosecution of that work by the British Iron and Steel Research Association, and the inclusion of the Report of the Committee on Stress Relief of Iron Castings in the forthcoming Institute of Metals symposium on internal stress. He hoped that by their acceptance of the Technical Council's Report, members of the Institute would endorse their policy of closer working with other associations. In conclusion, he expressed his appreciation of the work of all the members of the Technical Council, and particularly of the deputy chairman, Mr. L. W. Bolton, who had carried on during his (the chairman's) absence through illness.

MR. L. W. BOLTON, seconding, thanked Mr. Peace, and said it was a great satisfaction to the members of the Technical Council to know that their chairman had made a good recovery. He thought the report showed a year of very considerable success and he had pleasure in seconding its adoption. The report was adopted.

On the suggestion of the CHAIRMAN, it was agreed that telegrams of greetings should be sent to the American, French and Belgian Associations. The chairman also reported that a congratulatory message had been sent to Prof. and Mrs. Turner on the occasion of their diamond wedding anniversary, and that Prof. Turner had replied with congratulations to the Institute on its work and prospects. It was also agreed that greetings should be conveyed to the Institution of Mechanical Engineers on the occasion of its centenary.

Annual Conference

Oliver Stubbs Medal

The CHAIRMAN remarked that the decision of the Literary and Awards Committee was unanimous that the Oliver Stubbs Gold Medal for 1947 should be awarded to Dr. A. B. Everest. In presenting the medal, the chairman expressed the hope that Dr. Everest would long possess it with pride, that his activities for the good of the Institute would continue, and that he would regard it as a slight appreciation of the original work he had done on behalf of the industry.

DR. EVEREST, responding, said he was very gratified that the council had thought fit to make the award to him, and he paid tribute to the facilities afforded him by the Mond Nickel Company, Limited, and its development department and research laboratories for carrying out technical work and attending committees of the Council of the Institute. He hoped to be able to serve the Institute for many years to come.

E. J. Fox Medal

The President, MR. D. HOWARD WOOD, announced that the award this year had been given by the assessors to Mr. T. Makemson, M.B.E., in recognition of his outstanding services to the foundry industry as secretary of the Institute for 21 years, and also for his outstanding work during the period 1940 to 1946 as Joint Director and later Director of Iron Castings in the Iron and Steel Control of the Ministry of Supply.

MR. E. J. FOX, in presenting the award, said it gave him more than ordinary pleasure to be able to make the presentation to their respected friend, Mr. Makemson. He had served the Institute well for 21 years, and for that reason alone, though there were several others, it gave him the greatest pleasure to be able to hand the medal to Mr. Makemson.

MR. MAKEMSON, in reply, said he was most deeply grateful to everyone concerned, to the council for awarding it to him, to the assessors upon whose recognition the council acted, and to members of the Institute for the very kind way in which they had received the award and for all the enthusiasm with which they had greeted it. As they had been told, it was almost 21 years since he became secretary of the Institute during the year when Mr. Faulkner was President. He had taken on the task with somewhat mingled feelings; he wanted to be secretary from some points of view, while at the same time he had also other ideas; but within a few years he realised he had achieved something which perhaps very few people had achieved. He thought he had found what was his niche, and hoped he was right. From that time forward, he decided the Institute was his job, and his life had become more or less intertwined with the Institute's affairs, and it had become more and more really and sincerely the absorbing interest of his life, except, of course, during those 6¼ years when he worked for the Government in an effort to do his bit towards winning the war and when other aspects of the foundry industry became predominant.

During the whole of that time, he had, of course, met many people and made many friends, and the point he wanted to make was that anything he might have achieved, however small, and any satisfaction he might have got out of his work with the Institute and with the Control, would not have been possible at all without the support and co-operation of all those friends and without their friendship, and he did want to say "Thank you" very sincerely to all the people with whom he had worked during his long official connection with the industry, to the Presidents of the Institute, to the Councils, to the Branch-Secretaries and to all the members, and also to those people with whom he worked so closely in the Iron and Steel Control; to Mr. Fitzherbert Wright, his Chief when on the Joint Control, to the Controllers and other Government officials, and to the various firms in the trade with whom he had worked so closely. Finally, he paid tribute to the support he had consistently had from the various people who had worked for him in the Institute's office, and particularly to his colleague Mr. Bolton.

Awards of Medals and Diplomas

The PRESIDENT said that the British Foundry Medal was awarded to the author of the Paper adjudged by the council to be the best presented in the preceding year, and on this occasion it had been unanimously decided to make the award to Mr. Basil Gray for his Paper on "The Production of 'Grand Slam' Bomb Castings," presented to the A.F.A. Conference in 1946 and also to the I.B.F. Conference, and he called on Mr. Barrington Hooper to present the medal.

MR. BARRINGTON HOOPER, C.B.E., made the presentation, apologising for the fact that the actual medal had not yet been received from the makers.

MR. GRAY said he wanted to assure everyone that he regarded the presentation as a very great honour, because it was the first time in his life he had ever had it shown to him that his Paper was even more worthy than his own ideas had deemed it.

Announcing that this year the award of the Meritorious Services Medal was to Mr. John Bolton, the PRESIDENT said exceptional work called for exceptional recognition. In handing the medal to Mr. Bolton, assistant secretary of the Institute and acting secretary during Mr. Makemson's 6¼ years' absence, they felt it was but small recognition of his great work. In March, 1938, John Bolton became assistant secretary after serving on the staff of the *Foundry Trade Journal*. He took full charge of the secretarial work from May, 1940, to August, 1946. Since Mr. Makemson had returned to his normal duties in August, 1946, Mr. Bolton had been particularly interested with the work of the Technical Council and the Institute publication, having been solely responsible for the preparation of the "Journal." Presenting the medal, the President added he was particularly happy to do so, feeling that Mr. Bolton was worthily taking his place among the distinguished recipients of the medal.

MR. BOLTON, in reply, said the award was established 14 years ago, when the council at that time desired to recognise the services of the late Mr. Finch, a founder member of the Institute, its first secretary, and

for many years its honorary treasurer. Mr. Bolton did not link his own name with that of Mr. Finch in any boastful way, but merely to remind himself of the traditions, responsibilities and high level of achievement at which he was expected to aim. Much as he appreciated the token, he regarded more highly the esteem in which they held his services. He thanked the President very much for his kind citation, and members for the warm reception which had been given to the announcement.

The secretary announced at the council meeting held the previous day that it had been decided to award diplomas for Papers, which had been given, to the following:—Mr. H. Taft, for his Paper "Experience with Balanced-air Feed in the Cupola," given before the Middlesbrough Branch; Mr. H. G. Hall, who gave "Malleable Cast Iron—Present Trend—What of the Future?" before the Birmingham Branch, and Mr. D. H. Young, for his Paper "The Production of Some Large Grey Iron Castings for Marine Engineering," given before the Scottish Branch.

Election of President, 1947-48

The PRESIDENT said the time had now arrived to put before members the council's recommendation as successor to himself. The Presidency of the Institute was a great honour, the highest that was in its power to confer on any of its members, and as he had discovered, that honour carried with it certain responsibilities. They all knew full well the qualifications which Mr. Percy H. Wilson had for the office. For more than 30 years, Mr. Wilson had been a prominent member of the foundry industry, well known for his pioneer work in the application of the principles of centrifugal casting in the manufacture of cast iron pipes and responsible for the design and introduction of the flexible piping joints which bore his name. During the war, he had been largely responsible for the design and operation of one of the largest plants in the country erected for the production of steel bombs and for which work he had been awarded the O.B.E. in 1943. Mr. Wilson was assistant managing director (technical) to the Stanton Ironworks Company, Limited, until 1943, when he was appointed to his present position of deputy managing director. He had been the recipient of the E. J. Fox Medal, and it was with the fullest confidence that Mr. Wilson's election would be unanimously approved by the meeting and with the greatest possible pleasure that he proposed Mr. Wilson be elected President of the Institute for the ensuing year.

The proposal was given an enthusiastic reception, and DR. C. J. DADSWELL seconded. Although he thought little could be added to what the President had already said about Mr. Wilson, he himself had personal interest in seconding the proposal, because Mr. Wilson was a member of the Institute of Mechanical Engineers, to which reference had already been made, and he thought that was an illustration of the joining of the professions of the engineer and the foundryman which had contributed so largely to the success of Mr. Wilson's career. That was to be seen in the application with other collaborators of the centrifugal casting process, which Dr. Dadswell considered stood as highly in this country as anywhere in the world, and then having pushed that process with great determination, Mr. Wilson had achieved during the war something which many of them had thought was going to be impossible, the mass production on a very large scale of bombs. Having visited Mr. Wilson's foundry during the war, Dr. Dadswell felt anyone would have to travel far to find another foundry where so much had been achieved for mass production, and he was convinced nothing better could be found. (Acclamation.)

The proposal was then put to the meeting and carried with enthusiasm, and Mr. Wilson was invested with the chain of office by the retiring President. MR. WOOD, in investing the new President, said he felt confident that he would wear it with dignity. He was reminded in looking at the jewel, of the inscription which he discovered a short time ago. The motto of this Institute was, "Science hand in hand with labour," but on examining this jewel, he found the late Mr. William Mayer had included a modified version of the motto, which he suggested was an improvement. The motto here in very small letters read, "Science hand in hand with the dignity of skilled labour." He suggested that those additional three words were a definite improvement, and he hoped that they would be adopted in future by the Institute.

Exchanging places with Mr. Wood, the PRESIDENT thanked the meeting for his election and asked Mr. Wood to continue as chairman until the end of the meeting. He added he was deeply conscious of the great honour conferred upon him, and knew that he was following some men who had held that important position whom it would be very difficult to emulate, but he assured members he would do all he possibly could to even further the interests of the Institute during his tenure of office.

Election of Vice-Presidents and Members of Council

MR. V. C. FAULKNER, proposing the election of Mr. R. B. Templeton as Senior Vice-President, recalled that Mr. Templeton first became associated with the London Branch some ten or fifteen years ago, and they had learned to appreciate his clarity of thought and lucidity of expression. On being appointed as president of that branch, he had conducted a recruiting campaign and had brought some most admirable members into the ranks of the Institute. He had also cut some red tape, and Mr. Faulkner remarked that Mr. Templeton would not stand any nonsense of the red tape variety, and the Institute could look forward to further progress being made when the time came for Mr. Templeton to preside. He was a technician of no mean order and there were on record brilliant Papers which he had given before the Institution of Marine Engineers and the Institution of Automobile Engineers, and the Institute of British Foundrymen was proud of these efforts which he had made. Since vacating the presidential chair of the London Branch he had been exceedingly helpful in the field of training and education. In London, he was virtually the creator of the classes at the Borough Polytechnic School, and he was also promoting an experimental scheme at Butterley, which they would all watch

with a great deal of interest, where the Meehanite Institute were carrying out a quite novel type of training for entrants to the industry. Mr. Faulkner concluded by paying a tribute to Mr. Templeton's exceedingly charming personality, and said he was sure the proposal for his elevation would meet with complete and enthusiastic approbation.

MR. FITZHERBERT WRIGHT seconded. He said he had sat with Mr. Templeton on many committees in the last few years and found him exceedingly efficient, and he thought the members would do well indeed to elect him as their Senior Vice-President.

MR. TEMPLETON, in a brief response, expressed his appreciation of the honour. He said he was fully conscious of the great responsibility of the office and would do everything in his power to carry on and uphold the high prestige and great traditions of his predecessors.

MR. S. H. RUSSELL, who proposed the election of Mr. N. P. Newman as Junior Vice-President, said Mr. Newman had always taken a great interest in the activities of the Bristol and West of England Branch, and it was only because of a rather serious illness that he had been prevented from taking office in that branch. He had a very intimate knowledge of the foundry industry and the Institute was fortunate in having the advantage of his capacity and experience.

MR. A. V. BIGGS, the retiring President of the Bristol Branch, said he had known Mr. Newman for many years and it gave him great pleasure to second the proposition. Mr. Newman was highly esteemed, not only in his native town, but throughout the West of England, and the wise counsel which he always gave so freely had greatly assisted the industry in the south-west. He was sure Mr. Newman would prove a very worthy Junior Vice-President. MR. NEWMAN, responding, said he was deeply conscious of the honour which had been conferred upon him and said he would do his best to further the progress of the Institute and would support the President to the utmost of his ability.

The ballot for the election of five members of the Council to succeed those who had retired by rotation resulted in the election of the following:—Mr. L. W. Bolton, Mr. H. W. Lockwood, Mr. E. Longden, Mr. J. H. Pearce and Mr. P. A. Russell.

Alteration of Bye-laws

Notice of motion in accordance with Bye-law 24 having been given, the following resolution was put to the meeting for adoption on behalf of the Charter and Bye-laws Committee of the Council:—"That certain of the bye-laws of the Institute which were adopted at the annual general meeting of the Institute held on June 19, 1946, subject to the approval of the Privy Council to the bye-laws as so adopted be further altered and added to as in the print laid before the meeting and that the bye-laws so altered and added to and as contained in the said print laid before the meeting be and the same are hereby adopted as the bye-laws of the Institute in lieu of the present bye-laws, such present bye-laws to cease to have effect and the bye-laws so adopted to come into force and effect when and so soon as the approval of the Privy Council of the bye-laws so adopted and the certificate of such approval under the hand of the Clerk of the Privy Coucil have been obtained."

Seconding, MR. JOHN BELL said he was a member of the Bye-laws Committee and the person who seconded the resolution at the last meeting, so he had much pleasure in seconding it again and trusted it would be unanimously adopted. The resolution was carried, and Mr. Wood said it was hoped they would have the approval of the Privy Council in the course of a few months and after the long vacation.

Presidential Address

Following the delivery of the Presidential Address, printed in our last issue, MR. D. H. WOOD proposed that the thanks of the Institute be accorded to the President for his statesmanlike survey of the industry and his suggestions for dealing with its problems. With regard to the President's reference to the necessity for minimising physical effort in the foundries, Mr. Wood said he understood that since 1944 the industry had spent £14 million on new buildings, mechanisation and equipment. With regard to the utilisation of foreign labour, some of which would be skilled in foundry practice, unfortunately the trades unions had not yet reached unanimity regarding the employment of such labour, which was disappointing, because although there was sufficient foundry capacity to provide all the castings required, owing to lack of labour, castings were being imported into this country from the continent.

Mr. Wood mentioned that a few days previously he had had the privilege of visiting the Stanton Foundry Training School, and he ventured to say that this was probably the most completely equipped private foundry school, not only in this country, but in Europe.

MR. N. P. NEWMAN, seconding the vote of thanks, referred particularly to the President's plea for a national wages policy. He said that he (Mr. Newman) had made a number of business journeys abroad during the past year and had come up against a very definite unwillingness to place business with this country on the basis of prices ruling at date of despatch. Obviously, no manufacturer could waive that clause unless on the one hand we had some reasonable wages policy and knew what our wages level was likely to be and, in the second place, had a "materials" policy. Obviously, this country and industry generally, and through it the foundry industry, was going to suffer unless we could put ourselves in the same position as the Americans, who at the present time in their foundry industry were quoting firm prices. He did sincerely hope that this important question of a national wages policy would receive due consideration. The vote of thanks was carried with acclamation, the President expressing his gratitude.

The CHAIRMAN said they were honoured by the presence of Sir Edward Appleton, who was to give the Edward Williams Lecture. They all knew that, apart from his connection with the D.S.I.R., he had always taken a very active part in development and research work generally, and he was sure they would find his lecture most interesting. The lecture is given on page 185 of this issue.

I.B.F. Annual Conference

New Metals For Old*

By Sir Edward Appleton, F.R.S.

During the last fifty years, many metals and, particularly, combinations of metals have taken the place of others in the manufacture of things that people require and use. Progress in this respect has followed largely as a result of scientific developments, though, in this subject of metallurgy, it is not unpleasant to admit that empiricism has, now and again, scored enormous successes. The late Lord Rutherford used to say that his subject of nuclear physics had some of the characteristics of a "Tom Tiddler's Ground." The same, to some extent, could still be said of metallurgy. There are still opportunities for "lucky dips."

Scientific research is a comparatively new form of human activity, while the extraction and fabrication of metals have been practised for thousands of years. Early man probably became aware of the useful properties of metals through the accidental discoveries of gold, copper and meteoric iron, which are occasionally found in a practically pure condition. It is known that gold and silver were used for adornment, but there is no doubt that the feature of metals, which would specially interest our ancestors, would be the fact that metals could be hammered into useful shapes to form sharp edged tools.

Eventually the use of metals extended, through the Bronze and Iron Ages, to the Steel Age, which may be considered to be represented by the last two hundred years. The last hundred years has seen the rise of the steel industry and at the same time the development of the science of metallurgy as distinct from the traditional arts of fabricating metals.

The Elements

In Nature there are 92 elements, 68 of which may be classed as metals; and it is most interesting to note that many of these 68 metals, which were merely chemical curiosities not so long ago, have now found their place in science and industry. Of these, aluminium and magnesium are the most noteworthy. The physicist has recently shown how the transmutation of one known element into another can be brought about using atomic projectiles which penetrate to the heart of an atom and alter the structure of the nucleus; but the quantities normally involved are so small that these transformations are not of practical consequence at present.

But he has also succeeded in producing two entirely new metals, neptunium and plutonium, the latter constituting the fissile material in one of the bombs dropped on Japan. These two metals, which are the heaviest known to man, are produced in uranium rods which form part of an atomic pile. The new metal neptunium, which is first formed as a result of the entry of a neutron into a uranium (238) nucleus, is radioactive and of short life and spontaneously turns into plutonium which must be extracted from the uranium rods before it can be used in an atomic bomb.

It is a remarkable thing that although there are as many as 92 elements, the earth's crust (down to 20 miles below the surface) is made up very largely of only a few of them. The five elements oxygen, silicon, aluminium, iron and calcium form over 90 per cent. and the seven elements, potassium, magnesium, titanium, hydrogen, phosphorus, carbon and manganese bring the total to 96 per cent. The two metals, aluminium and magnesium, which are likely to play an increasingly important part in the engineering of the future, contribute as much as 10 per cent. by weight to the earth's crust.

If 12 of the elements are responsible for 96 per cent. of the earth's crust 80 elements are left, which do not contribute more than 4 per cent. by weight, but it turns out that, though relatively scarce, more than half of these 80 elements are metals which are useful to our present civilisation.

In attempting to provide new metals for old, it is important to note that science has provided the metallurgist with methods of accurate measurement by which metals and alloys may be tested. In other words, if one knows the type of qualities desired in a metal, it is possible, by measurements on specimens, to say how far any particular metal fulfils those requirements. The properties in question may be strength, hardness, durability, machinability, resistance to corrosion—in air, in water or in the ground—thermal capacity and expansion, electrical conductivity, magnetic permeability or retentivity and so on.

One hundred years ago, man was practically limited in his use of metals—apart from the precious metals gold, silver and platinum—to wrought and cast iron, steel, copper, lead, tin, zinc, antimony and bismuth; and such alloys as bronze, brass and solders. To-day there are several thousand alloys in every-day industrial use.

Electron Microscope and Structure of Metals

It is important to note that many of the properties of alloys are not wholly determined by their chemical composition, but by the fine details of their interior structure invisible to the unaided eye. In the investigation of that structure, the metallurgist uses many tools such as the optical microscope, the X-ray diffraction apparatus and the electron microscope. The latter is one of the latest weapons which science has put at the disposal of the metallurgist. Its operation depends on the fact that electric and magnetic fields can be made to act on an electron beam in somewhat the same way as glass lenses do on a light beam. Ordinary visual microscopes cannot be used on metals effectively at magnifications over about 3,000, nor can they give any information about structures, the detail of which is smaller than the wavelength of the light employed. By using high-speed electrons, however, which behave as if they were waves of extrevely small wavelength, and suitable electric and magnetic lenses, the electrons transmitted through any

* The Edward Williams lecture delivered on June 18, at Nottingham.

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object can be focused on a photographic plate. Since metals are opaque to electrons except when in the form of very thin films, the structure of metals is investigated by making a replica of the etched surface of a metal by means of a thin film of formvar or silica obtained by an evaporation technique. The film is then stripped off and examined in the electron microscope. Under the most favourable conditions of shape and size, objects of the order of one hundred millionth of an inch in size should be capable of being observed. This size is comparable with the dimensions of molecules of somewhat complex organic compounds.

Corrosion and Protection of Metals

It is generally true that things, if left to themselves, usually revert to their most stable form if nothing is done to prevent it. The same is broadly true of metals. As a rule their most stable states are the ores in which they occur in the earth's crust and what we call corrosion is largely the attempt of the metal to get back to this most stable state. Generally speaking, it is the action of oxygen which is the cause of corrosion so that it is rather analogous to combustion or burning. One of the major problems is to prevent the corrosion of metals—metals which have been produced by much labour involving the reduction and melting of the metal with carbon-bearing fuels. In the case of iron and steel used for constructional purposes, the simplest protection against atmosphere consists of layers of paint. It has been estimated that the annual cost of treatment of the British output of iron and steel in this manner is not less than £40,000,000. Sir Robert Hadfield, on the other hand, has also estimated that the world's annual loss by corrosion amounted to nearly £600,000,000 as far back as 1922, and it is likely that this figure is now exceeded.

Stainless Steel

An important victory in the war against corrosion was the introduction by Brearley of chromium stainless steel. This is one of the great unexpected discoveries, which we come across so often in the history of science. Brearley in 1908 was attempting to find an improved steel for gun barrels and, in the course of his work, tried the effect of the addition of chromium. The story goes that some specimens he had made of a 13-per cent. chromium steel were thrown out on the scrap heap and Brearley was surprised to notice a few weeks later that they had remained bright and untarnished. A scientifically minded man like Brearley just had to get to the bottom of this and the result was the discovery of stainless steel. Later the 18-per cent. chromium, 8-per cent. nickel type and other austenitic high-chromium steels were produced. The latter were destined also to form the basis of many heat resisting, *i.e.*, non-oxidising steels, which have been developed in recent years. The cost of these steels, on account of the expense of alloying elements and the relatively high cost of fabrication, are factors which, at present, limit the application of these alloys. The effectiveness of the chromium in these steels is due to the fact that chromium oxidises very rapidly. A film of chromic oxide is thus formed which is very tenacious and continuous; it is this film which effectively stops further oxidation. If the surface of the steel is scratched the protecting film is immediately renewed from below. Dr. Vernon at the Chemical Research Laboratory of D.S.I.R., has succeeded in detaching specimens of the actual films which were found to be about 100 angstrom units thick, *i.e.*, a millionth of a centimetre. Films of zinc, cadmium, lead and aluminium applied by diverse methods are also used to reduce corrosion.

The Corrosion Research Committee of the Iron and Steel Research Council, now remodelled as the British Iron and Steel Research Association, have carried out atmosphere corrosion experiments by exposing standard test specimens to the atmosphere in many parts of the world. The rate of corrosion of unpainted mild steel in a large industrial town is estimated at 2.7 thousandths of an inch per annum, whereas at a small town in mid-Wales, the corrosion rate is about one quarter of this value. The effects of atmospheric conditions on the rusting of iron have also been tested in the Chemical Research Laboratory by Dr. Vernon, who examined the attack in air in the absence of contamination, and then in SO_2, and also in SO_2 and ammonium sulphate. The effect of these two reagents was found to be additive. It was noticed that on dusting the surface with charcoal, the SO_2 had a markedly increased corrosion rate.

Corrosion on Condenser Tubes

Corrosion of the brass tubes in the condensers of steam-driven ships, particularly in battleships, was a source of great trouble in the first world war. These tubes through which sea water circulates, are used to provide the cool surface for the condensation of steam in "closed feed" circuits. During the first world war, a not inconsiderable fraction of the fleet was at all times out of action with repairs to the condensers In the recent war, largely as a result of work by the British Non-ferrous Metals Research Association, condenser tube trouble almost disappeared in spite of the more arduous conditions, which modern steam raising practices impose. In between the wars, alloys had been developed consisting of either an addition of 1-1½ per cent. of aluminium to the 70/30 brass or of a cupro-nickel alloy containing 70 per cent. copper and 30 per cent. nickel, with the deliberate addition of 0.5 per cent. iron. Mr. Churchill testified to the corrosion resistant properties of these new alloys in the House of Commons in 1940; when speaking of our warships, he referred to the trustworthiness of their engines and the absence of "condenseritis" so that "now they seem to steam on almost for ever."

Fundamentally, the cause of corrosion is the chemical attraction between metals and the oxygen of their environment. With stainless steels, protection is given by means of the self-repairing film of chromic oxide. Aluminium in the pure form has the somewhat similar property, and exposure to oxygen produces on it a thin film of aluminium oxide, which very effectively protects it from further attack. Now pure aluminium finds

many applications in industry, but it is not very strong, so that where mechanical strength is required, aluminium alloys are used. These, however, are not by any means as resistant to corrosion as is pure aluminium. The solution has been found in the now well-known anodising process developed at the Chemical Research Laboratory. This is an electrolytic process in which the article to be anodised forms one of the electrodes in a solution through which an electric current is passed. Oxygen is liberated from the solution and builds up a very tenacious film of aluminium oxide of great hardness. The surface film can be coloured by means of dyes and so the anodising process can be used for decorative as well as protective purposes. This is an example of fundamental research leading to the formation of a new commercial process.

Deformation of Metals

One of the reasons for the use of metals is that they resist deformation under stress or tension. One of the important problems facing the theoretical physicist is of explaining why metals break, or in its converse form, why metals hold together. Sir Isaac Newton set this problem more than two hundred years ago. In his treatise on optics, he wrote, "the parts of all homogeneal hard bodies which fully touch one another stick together very strongly. . . . There are therefore agents in Nature able to make the particles of bodies stick together by very strong attractions. And it is the business of natural philosophy to find them out." This problem has proved a most difficult one, and there is not yet a theory of cohesion, the predictions of which agree with experience.

Much of the work of both theoretical and experimental investigators of the theory of the metallic state has been concerned with finding out and accounting for the behaviour of single crystals under various stresses. Estimates of the strengths of single crystals of metals can be made by a number of theoretical methods, but the values obtained are always greatly in excess of those found in practice. According to calculation the maximum shear stress for a single copper crystal should be about 400 tons per sq. in., whereas the ordinary polycrystalline form of the metal has a yield stress of about 6 tons per sq. in., while single crystals of copper undergo plastic deformation under stresses as low as 0.1 tons per sq. in.

A single crystal of copper in the form of a rod ½ in. dia. can be bent in the hand easily to form a semi-circle. During this operation, the resistance to bending noticeably increases and it requires very considerable force to straighten it again.

Strength in Metals

Recent developments of metallurgical science show that high-tensile strength is not readily attained in simple metallic states. It is found, in fact, in atomic arrangements, which are markedly distorted. Such conditions are brought about by cold working, alloying, age-hardening, or quench-hardening.

In order to explain the fact that real single crystals are far weaker than the ideal single crystals imagined by the theoretical physicist, it has been suggested that no real single crystals are ever perfect over other than very limited regions. It has been suggested that there are in crystals numerous small faults, where the crystal structure has got out of joint or out of step. A two dimensional analogy is that instead of a row of atoms being directly opposite another row of atoms, one of the rows has one atom too many. It is suggested that sliding of one plane in the crystal over another is due to the progressive movement of the dislocations step by step across the crystal. This produces the same effect as simultaneous sliding of the whole plane, although at any one moment only a relatively small number of atoms are moving, and in consequence the force required to produce shear is seen to be much less than would be necessary if the crystal were really perfect.

Considering the problem of why polycrystalline crystals are so much stronger than single crystals, it seems as if the extra strength of the polycrystalline material must be due in some way to the boundaries between the crystals. At these boundaries the atomic arrangement must be disturbed over a region a few atoms thick so that when yield occurs in a crystal and a dislocation arrives at a crystal boundary, it is unable to cross the disturbed region and is dissipated. An initial internal slip in a small crystal in a polycrystalline material is thus seen to be confined to the crystal in which it started and unless such slips occur in many crystals simultaneously, no plastic yield takes place in the material as a whole.

On this theory, it follows that, if the number of crystals per unit volume is increased either by the effect of cold working or by the introduction of alien atoms between the crystals, *i.e.*, by the formation of an alloy, the propagation of dislocations is impeded and this means that the metal becomes stronger.

Creep of Metals

Two national problems to-day, are the efficient use of coal and the generation of electricity. These problems are limited in the efficient design of the steam-raising plant. The achievement of increased efficiency depends on the use of higher temperatures and higher pressures and this, in turn, demands materials which can stand up to the new exacting requirements. Thanks to the new materials which the metallurgist has produced, the efficiency of large electrical generators increased by more than 65 per cent. in the 15 years before the war and progress is still being made.

One of the difficulties of using metals at high temperatures under prolonged stress is their liability to flow or creep and so change their dimensions. Much attention has been given to this phenomenon at the National Physical Laboratory and elsewhere. The subject has been of particular importance in connection with the development of gas turbines for aeroplane propulsion in which materials are subject to very great prolonged stress at high temperatures. It is rather extraordinary to think that under high temperatures and prolonged loading a piece of steel behaves similarly to a lump of pitch and slowly stretches until it breaks. For example, in a certain nickel-chromium steel at 600 deg. C. a stress 0.4 tons per sq. in.—less

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than 1/40th of the breaking strength determined from the ordinary tensile tests at 600 deg. C.—if continuously applied, causes the alloy to "creep" or stretch at a rate of 10^{-5} in. per in. per day. This is equivalent to an extension of one inch in a 100-in. bar in about three years. Of course a number of other metals are more liable to creep than steel, some even at air temperatures. Tin is a case in point and this metal provides a convenient means for approaching the scientific study of the phenomenon. Creep is largely influenced by grain size. As the grain size diminishes the creep rate decreases to a minimum, after which, further decrease in grain size leads to increase in creep rate.

Although the effect of grain size can be readily noted in the case of tin, the phenomena accompanying creep in other metals are exceedingly complex and the effect of grain size is sometimes obscured by other factors such as the initial degree of cold work, and the rate of cooling of the metal.

During the war, the development of materials for high-temperature service in gas-turbine blading has been actively pursued by several organisations in this country, and various materials, the majority of which can be regarded as special steels, have been developed. These materials were on the secret list during the war but their properties are now being made known. For example, a material known as G.18B contains approximately the following percentages:—Carbon = 0.4; nickel = 13.5; chromium = 13.5; tungsten = 2.5; molybdenum = 1.8; cobalt = 10.5; niobium = 3.4; iron about 53.

Under a steady load of 5 tons per sq. in. applied at 800 deg. C. this material creeps 0.2 per cent. in 100 hrs. Information of this character is essential for the design of engines for jet aircraft.

Other materials such as Rex 78 and Rex 357 have been developed, and the stress to produce fracture in 1,000 hrs. at various temperatures has been determined.

Nimonic 75 and 80

A further type of material has been developed from the 80/20 nickel-chromium alloy originally produced by Marsh in 1908, which was known to possess reasonably good mechanical properties combined with high resistance to oxidation at high temperatures. One improvement on this alloy is Nimonic 75, which has been strengthened by titanium additions causing titanium carbide particles to be dispersed throughout its structure. It is largely used in sheet form in the construction of flame tubes of combustion chambers fitted to the gas turbines.

Nimonic 80—a further modification of the original 80/20 nickel-chromium alloy—has, in addition to good oxidation resistance, a high resistance to deformation by creep under stress at high temperatures. This alloy, which gains its superior creep resistance from the precipitation of a complex intermetallic compound of nickel, titanium and aluminium, is now being widely used for the blades of British jet engines. Details of the high-temperature creep properties of Nimonic 80 are not yet available.

Materials for Special Purposes

Mention cannot be made here of more than one or two of the great number of alloys, the manufacture of which has been prompted by special needs. Take, for example, the need of a firm manufacturing large wireless valves. Here, a metal which has the same thermal expansion as the glass of the valve envelope is required. A 39-per cent. nickel-iron alloy has been found satisfactory for this purpose. Again, take the musician's tuning fork. Here is needed a material with a low thermal expansion—so that the pitch will not alter—and a low internal viscosity—so that the note struck will last a long time. Invar (36 per cent. nickel), containing also 5 to 8 per cent. of chromium, improved in strength by a titanium addition, has proved very suitable for this purpose.

Mention might be made, too, of the new ceramic cutting tools, which seem to offer possibilities in the machining of aluminium and other soft metals; and also things like ebonite and carbon-filled vulcanised fibre. Strictly speaking, such materials are not metals, but metallic oxides. Commercial use of these materials has not yet been achieved, owing to erratic crystal growth during firing, but selected specimens have surpassed tungsten carbide tools for certain cutting operations; and research is now in progress with the object of producing uniform material of great strength.

Finally, everyone is becoming familiar with the new alloy used in our coinage. Our silver coins used to be made of an alloy containing 50 per cent. of silver, 40 per cent. of copper, 5 per cent. of nickel and a similar amount of zinc. For the coinage struck in 1947, a 75/25 nickel/copper alloy is being used, in view of the necessity to save silver. I don't think that everyone would agree that the new metal is better than the old in this particular connection!

Electrical Materials

According to an early theory, due to Drude, the conduction of electricity along a wire was due to the slow drift of free electrons, the atoms of the conductor remaining fixed. But, as time has gone on, many facts have been disclosed which the old theory has failed to explain. In particular, it has been realised that the old theory gave completely wrong values for the specific heats of metals. In recent years, a quantum theory of metals has been developed which is capable of explaining most of the outstanding phenomena. Meanwhile, practical knowledge of the electrical properties of metals has been similarly expanding.

Copper in the pure state is very widely used in the electrical industry on account of its high electrical conductivity. When used as overhead cable in long spans the cable must not only have high electrical conductivity but must have considerable strength to support its own weight and stresses due to wind or ice formation. Increase in strength can easily be obtained by alloying with another metal, but any substantial increase in strength is generally accompanied by a serious decrease in conductivity. If cadmium, however, is used as the alloying element it is possible, by adding 0.9 per cent., to obtain a very substantial increase

in strength with only 10 per cent. reduction in conductivity. This alloy is used for trolley wires and for carrying the grid across the Thames at Dagenham. In the form of light cables it has been extensively used for communication purposes during the war, particularly during the various landings and also by parachutists in the desert and Burma, where it came to be known as "tree wire."

Magnetic Materials

It has been a mystery for years why the magnetic behaviour of iron, nickel and cobalt should be so very pronounced and exceptional. Recently, a promising theory of ferromagnetics, as they are called, has been developed, in which the ultimate and elementary magnetic particle is identified as the spinning electron itself. Moreover, it is found, according to this theory, that the exceptional magnetic qualities of iron, nickel and cobalt can be satisfactorily explained as due to the particular sizes of the electron rings in those atoms.

For different applications, materials having widely differing magnetic characteristics are required and improvements in magnetic properties have accordingly taken place in two exactly opposite directions. On one hand, materials as magnetically "soft" as possible are needed, for example, in transformer cores, electromagnets and relays. In these materials we want to produce intense magnetisation with a weak imposed field and to reverse the magnetisation with a small energy loss; in other words, we want high permeability and low hysteresis. On the other hand, materials as magnetically "hard" as possible are required for permanent magnets, such as are used in loud-speakers, magnets, electricity meters and an immense range of other instruments. Here, after magnetising to saturation and cutting off the magnetising current, the magnetisation remaining, or "remanence" must be large, and, in addition, the reversed magnetising force needed to destroy the magnetisation —to "degauss" the material in present-day phraseology—must also be large. In other words, it must have a large "coercive force." The combination of large remanence and large coercive force means that the material has a high hysteresis loss, so that in this respect the requirements for permanent magnet materials are the opposite of those for the "soft" type of material.

The materials of which the greatest quantity is used for magnetic purposes are the sheet steels from which the cores of transformers and the armatures of generators and motors are made. Besides fulfilling the conditions for a soft-magnetic material, these steels should have high electrical resistance to reduce the heating due to the eddy-currents produced when the magnetisation is reversed. In addition, their mechanical properties must allow of their being readily rolled into sheets, and finally all these properties must be attainable at a reasonable cost.

Tests show that soft iron is satisfactory in so far as the magnetic properties are concerned. Its hysteresis loss for a maximum flux density of 10,000 gauss and a frequency of 50 cycles per second is somewhat less than 1 watt per lb. (2 watts per kg.). It has, moreover, been shown that by reducing the percentage of impurities—notably carbon and oxygen—this loss could be reduced to about a twentieth. The labour involved in the purification process is very great, however, and the cost would be prohibitive. Further, the electrical resistance both of high purity and of commercial soft iron is low. The iron-silicon alloys, first introduced by Sir Robert Hadfield over 40 years ago, go far to meet the various requirements. The resistance increases progressively with the percentage of silicon. This is limited, however, to about 4 per cent. by the increasing brittleness, which makes rolling difficult above that figure.

Silicon and Nickel Alloys

Compared with the best (Swedish charcoal) iron, the use of silicon alloys gave an immediate reduction of about 50 per cent. in the losses. Improvements in purity and in heat-treatment gradually produced a further reduction of about 50 per cent., and since about 1930 yet another reduction of nearly 50 per cent. in the loss has been obtained by the introduction of a special cold-rolling technique which has given us the materials known as Hipersil (American) and Crystalloy (British). For these materials the total losses due to hysteresis and eddy currents for 10,000 gauss and 50 cycles per second are only about 0.3 watt per lb. (0.65 watt per kg.). At the same time, the permeability at working flux densities has been increased about 10 times compared with Hadfield's original silicon-iron.

The basis of this most recent improvement is the fact that the crystals of which iron is composed, which are of cubic shape, have better magnetic properties parallel to the edges of the cube than in any other direction. If, therefore, it can be arranged for all—or at least a large proportion—of the crystals to lie with their edges in the direction in which the material is to be magnetised, one should expect to get improved properties in that direction. This is precisely what is done by the elaborate cold-rolling process used in producing these sheets, which tends to make the crystals lie with the cube-edges in the direction of rolling.

Another group of materials having high permeability in weak fields and small hysteresis loss is the iron-nickel alloys of which Permalloy and Mumetal are outstanding examples. These are widely used in communication engineering, for example, in loading coils and high-frequency transformers, as well as in electrical instruments and current transformers.

The highest initial permeability is obtained in the 78.5 per cent. nickel alloy, but for this material the resistance is low and the material saturates at a comparatively low flux density (about 8,000 gauss, compared with over 20,000 in soft iron). Improvement in both these respects is obtained by using alloys with a lower nickel content. The resistance may also be increased—though the saturation point is still further lowered—by adding small percentages of molybdenum, copper or chromium. These also increase the initial permeability, which may have a value of about 20,000

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as compared with something over 200 for soft-iron dynamo sheet.

A special application of soft magnetic material is in the manufacture of the "dust-cores" used in transformers and inductances for telecommunication work. Here, in order to ensure accurate reproduction of speech or other signals and to avoid waveform distortion, the object is to attain a constant value of permeability when the magnetising current is varied rather than a high value of permeability in itself. With this object, a large number of small air-gaps are introduced into the magnetic core by reducing the material to a fine powder and compressing the particles in a suitable insulating and binding medium. This subdivision of the material greatly reduces the effective permeability, but makes its value much more nearly the same for different magnetising currents. It also reduces the losses due to eddy currents which become relatively more important as the frequency is increased.

Nickel-iron alloys are largely used for making dust-cores, but another material, which is particularly suitable at the higher frequencies (above about 100,000 c./s.) is carbonyl iron, a very soft iron prepared by a special chemical process in the form of spherical particles a few thousandths of a millimetre in diameter. No special pulverising process is therefore necessary with carbonyl iron. Before the war, the manufacture of carbonyl iron was almost entirely limited to Germany, but during the war, suitable plant was constructed in this country and carbonyl iron at least as good as the German product is now obtainable here.

Magnetic Hardness

Turning to improvements in the opposite direction, namely, greater magnetic hardness required in materials for permanent magnets, equally striking advances have been made. As mentioned before, the quality of a permanent magnet material depends primarily on the remanence and coercive force. Examining the point more closely, it is found that it also depends on the way in which the remanent flux density diminishes as the reversed magnetising force is increased up to the coercive force value.

Up to about 1880, carbon steel was the only permanent magnet material available. Then it was found that 6 per cent. tungsten steel gave a better performance, besides weakening less with time, or, in other words, "ageing" less. About 1920, Honda in Japan showed that 35 per cent. cobalt steel was three or four times better than tungsten steel. Owing to the large percentage of cobalt, it was, however, relatively expensive and a series of cobalt steels with lower percentages of cobalt were developed for use where the requirements did not justify the use of the more costly material.

The next big advance was also made in Japan, when it was discovered about 1930 that alloys, containing approximately two parts of iron to one of nickel and one of aluminium, after suitable heat-treatment, had a much higher coercive force and were superior to any previously known material. A small magnet of this material, weighing only 20 oz., was capable of supporting a weight of 56 lb. This discovery was of particular interest, since, unlike all previous permanent magnet materials, these did not contain any appreciable quantity of carbon and were therefore not strictly "steels." They do not generally develop their full hardness when quenched, but only after subsequent tempering. Alternatively, they may be hardened by casting, provided the rate of cooling is suitable. Further improvements in alloys of this type have been effected by adding small percentages of cobalt and copper, the resulting complex alloys being the well-known "Alnicos."

In the latest alloys, such as Alcomax II, Alnico V and Ticonal, improvement has been obtained in quite a different way. By applying a magnetic field during the process of cooling a large increase in the remanence values is obtained in the direction of the applied field. In the perpendicular direction, a decrease is produced and it is therefore important, as with anisotropic silicon-iron sheet to design the magnet so that the material is used in the favourable direction only. These alloys are the most powerful permanent magnet materials at present available commercially, with a nearly twentyfold improvement since the days of carbon steel. With these powerful alloys, it is possible to construct permanent magnets capable of providing fields of the same order as those given by large electromagnets. Moreover, permanent magnets have the advantage over electromagnets that they are free from the liability to variations in strength, due to current fluctuations and the heating produced by the magnetising current. Where extreme constancy of field-strength is required, therefore, permanent magnets of present-day alloys can compete successfully with electromagnets in all except very large sizes.

Cast Iron

It is appropriate to say a few words about the results of research of interest to the foundry industry, particularly with reference to cast iron. In this field foundrymen are fortunate in being served by an extremely efficient co-operative research organisation, namely, the British Cast Iron Research Association. On the one hand, the Association has contributed by carrying out valuable fundamental research which has led to the development and to the production of new cast irons having very remarkable properties. On the other hand, it has materially helped the industry, which is, of course, largely composed of small firms, who must rely on such an Association for assistance in overcoming their day-to-day problems and in general improving the technique of manufacture.

There are few materials which have undergone such remarkable improvements in recent years, as cast iron. Twenty-five years ago a cast iron with a tensile strength of 15-18 tons per sq. in. was considered exceptionally good. Nowadays cast irons are commercially available with a tensile strength of 30 tons per sq. in. In addition, cast iron alloys have been produced to meet special requirements of industry, such as heat

resistance or corrosion and wear resistance. The Research Association has played a prominent part in the research which has led up to the production of these new materials.

The conditions in the blast furnace or melting ladle and the chemical reactions which go on inside them, are extremely complicated. We are still a long way from understanding them fully, but the more we understand them, the easier it is to control the composition and the quality of the molten liquids which eventually solidify into the materials in which foundrymen and their customers are really interested. The object of the fundamental research carried out by the Cast Iron Research Association is to gain this new knowledge. The methods employed have their origin in the studies of physicists, chemists and metallurgists on atomic and crystal structure, on the physical and chemical properties of metals and of the changes which take place when molten metals solidify.

It is the application of such studies as these that has provided the guiding principles, the background knowledge, the inspiration and ideas which have led to many practical advances. From this kind of work have come the clues which have resulted in what has been described as the greatest metallurgical development in cast iron of the present century, which was announced on the 25th birthday of the Research Association. Broadly this consists of taking a relatively high carbon iron, which is easily melted, readily poured, and, without any special alloy additions cast it so that it solidifies as a material having properties which rank it among the high-duty irons. This is done by treating the material so that on solidification the carbon is in the nodular instead of the flake form. This makes the metal similar in its structure to malleable cast iron. Hitherto, the only known way of doing this has been to submit white castings to very lengthy heat treatment.

The Association has not yet disclosed the exact nature of the process, but it is rapidly nearing a commercial stage. The results obtained certainly suggest that the new material may lift cast iron on to altogether a new plane. I want to urge upon your Institute, and also upon you as foundrymen, to support the Research Association as strongly as you possibly can, and bring to speedy fruition the last stages in the development of this important all-British discovery, which may well prove in the future to be a first-rate national asset.

Conclusion

An attempt has been made to illustrate the way in which scientific inquiry and experimental measurement, with now and again an empirical enterprise, have led to the discovrey of better metals for practical use. Physical science, as known to-day, grew originally out of the study of practical lore, and ever since it began to stand on its own feet as an independent theoretical interpretation and shorthand description of nature, it has often received fresh stimulus by coming back to practical problems. The study of the metallic state is now proving a fertile, if yet a difficult, field of inquiry for the theoretical worker; and there can be little doubt that when we possess a deeper understanding of the atomic architecture of metals, both simple and compound, and especially of the nature of the inter-atomic forces —the mortar between the bricks if you like—we can expect such fundamental knowledge to point the way to yet further practical improvement. The philosopher Francis Bacon, about 300 years ago, used to distinguish between light-giving experiments (*experimenta lucifera*) and experiments of practical utility (*experimenta fructifera*). It is true that the theoretical worker is consumed mainly by his curiosity to know and understand all about things. He desires to bask, one may say, in the light of understanding. But the experiments which Bacon called *lucifera* certainly provide the surest, and often indicate the quickest way to the experiments which he called *fructifera*. Yet, in the partnership of science and practice, the assistance rendered is by practical knowledge and it has nothing to gain, but indeed much to lose, by forgetting or neglecting to seek further inspiration and assistance from its origins.

Vote of Thanks

Mr. R. B. Templeton, proposing a vote of thanks to Sir Edward Appleton at the conclusion of his lecture, said it was rarely they had the opportunity of listening to a talk on a complex subject presented in such a fascinating and practical manner, and they were all grateful to Sir Edward for the enjoyment and interest he had given them. Mr. J. G. Pearce, seconding, said that his close contact with the D.S.I.R. since Sir Edward became secretary had shown him that, in Sir Edward, the Department not only had a scientist of the first rank in the field that he had made his own, but also an able administrator, who was building up the Department to the place of front-rank importance which its activities deserved. Their good fortune in having Sir Edward to give them the Edward Williams lecture was tempered only by their knowledge of the passing of the man after whom it was named. The vote of thanks was carried with applause.

Sir Edward Appleton, replying, thanked the members for making him feel so much at home. He added that nowadays he was ninety-nine per cent. administrator and only one per cent. scientist, and therefore being invited to give the lecture had been like a "scientific oasis in an administrative desert!" (Laughter.)

READERS interested in the purchase of radial arm casting machines from Government surplus stores should ring Mr. F. S. Jones at Great Barr 1794. Tenders must reach the Director of Contracts, Ministry of Supply, Great Westminster House, Horseferry Road, London, S.W.1, by July 2.

Foundry Supplies.—The Scottish Foundry Supply Company (James W. Joss, Limited), 55, West Regent Street, Glasgow, have sent us a four-page leaflet listing alphabetically the materials and plant they supply.

New Trade Marks

The following applications to register trade marks appear in the "Trade Marks Journal":—

"CYCA"—Dynamos. CYCALITE, LIMITED, 47-59, Hopton Street, Southwark, London, S.E.1.

"ENGLIT"—Metal pipes and tubes. J. ENGL, LIMITED, Treforest Trading Estates, Pontypridd.

"FULMEX" — Electric resistors, etc. ELECTRO METHODS, LIMITED, 112, Brent Street, London, N.W.4.

"KAIDY"—Washing machines and machine tools. KAIDY (ENGINEERS), Hutton Buildings, West Street, Sheffield.

"ACHILLES"—Anti-friction bearing or babbitt metal. E. TARRANT EVANS & COMPANY, 57, Ophir Road, Bournemouth.

"HEPOLITE OILMASTER"—Piston rings. HEPWORTH & GRANDAGE, LIMITED, St. John's Works, East Bowling, Bradford.

"SHAW" (DEVICE)—Metal locks. ARTHUR SHAW & COMPANY, LIMITED, Denver Works, Morfital Lane, Willenhall, Staffs.

"SILCATEX"—Abrasive preparations and products. TEX ABRASIVE, LIMITED, 138, West Kensington Court, London, W.14.

"ELMET"—Metal nuts, bolts and washers. JAMES MORRIS PAUL, 8, Moor Road, Moor Lane, Sherburn-in-Elmet, Yorks.

"ISOTROL"—Electric motors. LANCASHIRE DYNAMO & CRYPTO, LIMITED, Trafford Road, Trafford Park, Manchester, 17.

"CRANOSTAK"—Mechanical stacking and hoisting apparatus. METAL VENTS, LIMITED, 17, College Avenue, Maidenhead, Berks.

HAND DEVICE—Electrical apparatus and appliances. THORN ELECTRICAL INDUSTRIES, LIMITED, 105-109, Judd Street, London, W.C.1.

"MAXIBRATER" AND "ROTABRATER" — Vibrating machines. C. H. JOHNSON (MACHINERY), LIMITED, Adswood Road, Stockport.

"RADYNE"—Electrical apparatus and instruments, etc. STATIC CONDENSER COMPANY, LIMITED, Toatley Works, Wokingham, Berks.

"SKY-HOOK"—Hand-operated and power-operated light mobile cranes. J. AUBREY & COMPANY, 77, Kettering Road, Northampton.

"DUBO"—Gauges. STANDARD GAUGE COMPANY, INC., c/o Frank B. Dehn & Company, Kingsway House, 103, Kingsway, London, W.C.2.

"PROTECTION" AND GAS-MASK DEVICE—Metal locks and latches. V. DUGMORE LOCK COMPANY, LIMITED, 21, Thornley Street, Wolverhampton.

"UNIVEX"—Electric welding electrodes and welding apparatus, etc. BERTRAND TURNER, 23, Iverna Gardens, Kensington, London, W.8.

"FORPOL"—Metal clips, etc., for girders and like constructional members. ELECTRICALS, LIMITED, 14, Claremont Place, Newcastle-upon-Tyne.

"FERGUSON"—Agricultural machines and implements. HARRY FERGUSON INC., c/o H. D. Fitzpatrick & Company, 94, Hope Street, Glasgow, C.2.

"AMBER CROSS"—Silencers and silencing apparatus and filters for machinery, engines and motors. VOKES, LIMITED, Henley Park, near Guildford, Surrey.

[*Applications to the Cutlers' Company, Sheffield*]

"PLASMOLD"—Die steel. THOS. FIRTH & JOHN BROWN, LIMITED, Atlas and Norfolk Works, Savile Street, Sheffield.

"OMEGA"—Locks and locksmiths' work. ROBERT SORBY & SONS, LIMITED, 139, Norfolk Street, Sheffield.

Obstacles to Greater Production

Mr. Arthur Woodburn, M.P., Joint Parliamentary Secretary to the Ministry of Supply, told the annual conference of the Amalgamated Union of Foundry Workers at Ayr, last week, that the two greatest obstacles impeding a wholehearted response to the Government campaign for greater production were the suspicion among workers in the older industries about the good faith of their employers, and the tendency of employers to expect workers to obey instructions blindly without understanding. The worker of to-day would never respond to that attitude. Up until now, he said, there had been no clear understanding among the workers that the extra effort would go to the nation and not be unfairly appropriated by dividend drawers. He appealed to both employers and workers to use the idea of the Joint Production Council as a basis for mutual help and urged upon them the need for seeking points of agreement.

Cast irons to-day had nearly doubled the tensile strength of 25 years ago, Mr. Woodburn continued, referring to the 25th anniversary of the British Cast Iron Research Association. It was also possible to produce high-duty irons and specially alloyed irons with improved resistance to rust and to the effects of heat. Recently the Association had announced the most striking development in the production of iron in the present century. They found by a simple process they could take a high-carbon iron which was rapidly melted, easily poured, and capable of being made into sound castings. Foundry workers would be interested in this new development in iron, as they realised what frequently the general public forgot, that cast iron was far superior to steel in a multitude of uses.

Obituary

MR. HENRY FRANK HOWELLS, a director of Howells (Electric Motors), Limited, Hanley, Stoke-on-Trent, died on June 15. Mr. Howells, who was 80 years of age, had been in ill-health for some years.

MR. JOHN LESLIE G. ROBINSON, secretary of the North-Western Regional Board for Industry, died on June 11, aged 45. He had been in ill-health for some time. He was formerly associated with the engineering side of the tobacco industry.

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News in Brief

A. LAKIN & SON, LIMITED, Sheffield, have become members of the Foundry Trades' Equipment and Supplies Association.

THE AILSA SHIPBUILDING COMPANY, LIMITED, have sold their branch shipyard at Ayr to the Ayr Engineering & Constructional Company, Limited.

THE MIDLAND AREA OFFICES of the Rockwell Machine Tool Company, Limited, are now at 132, Steelhouse Lane, Birmingham (telephone: Central 3692-3).

NEWTON CHAMBERS & COMPANY, LIMITED, are building a 2,000,000- cub. ft. capacity gasholder for Peterborough Gas Company. The value of the contract is £78,500.

EXPORT DELIVERIES during 1946 represented a record in value and were almost double those of 1938, said Lord Aberconway, chairman, presiding at the annual meeting of Thos. Firth & John Brown, Limited.

IN THE METAL, engineering and shipbuilding industries in April last, 12,000 working days were lost by 3,500 workers involved in 37 stoppages, compared with 42,000 working days, 26,700 workers and 52 stoppages in March.

BRUCE PEEBLES & COMPANY, LIMITED, engineers, of Edinburgh, announce that their works will be closed from July 5 until July 14 for the Edinburgh trades holiday. No goods will be received or despatched during that period.

THERE WAS A RESUMPTION of work last week at the Sun Foundry, Coatbridge, of Stewarts and Lloyds, Limited, after a stoppage lasting over a month, due to the withdrawal of a war bonus of 8s. weekly being opposed by the men. It is understood that a weekly increase of 4s. has been awarded and accepted.

METAL INDUSTRIES, LIMITED, which already owns more than 75 per cent. of the share capital of Sentinel (Shrewsbury), Limited, has made an offer to existing shareholders of that company of one £1 "B" ordinary share of Metal Industries for every 10 Sentinel 2s. ordinary shares, and 8s. 6d. cash for each 6s. 6 per cent. cumulative preference share.

THE SHORTAGE OF MOULDERS is still acute and appears likely to remain so, but the bringing into further production of other departments has been a compensating factor, says Mr. H. E. Hind (chairman) in his statement with the annual accounts of Triplex Foundry, Limited. The directors have under consideration a programme of capital expenditure, including the installation of a mechanised moulding plant to improve output and to utilise a different class of labour. At the same time, they could continue to employ their present type of moulders in even larger numbers, as they have the room available for both purposes and the demand for their products is potentially great. The liquid resources of the company are adequate for the financing of this scheme, but the benefits will not accrue for at least two years, he says.

Personal

MR. W. E. LOVERIDGE has been appointed resident director of Richardsons Westgarth & Company, Limited, at Hartlepool, in succession to MR. W. NITHSDALE.

MR. WILLIAM M. MCKENZIE, assistant secretary, has been appointed secretary and chief accountant of Bruce Peebles & Company, Limited, engineers, of Edinburgh.

MR. J. P. LEWIS has been appointed by Edgar Allen & Company, Limited, Sheffield, to an executive post in connection with the production of their engineering products.

MR. J. D. BEDDOWS has resigned his position as chief metallurgist to the Aluminium Development Association to take up an appointment as technical manager with Anochrome, Limited, Walsall.

MR. S. F. STEWARD, of E. R. & F. Turner, Limited, Ipswich, who was Director-General of Machine Tools under the Ministry of Supply during the war, has been co-opted to the Council of the British Engineers' Association.

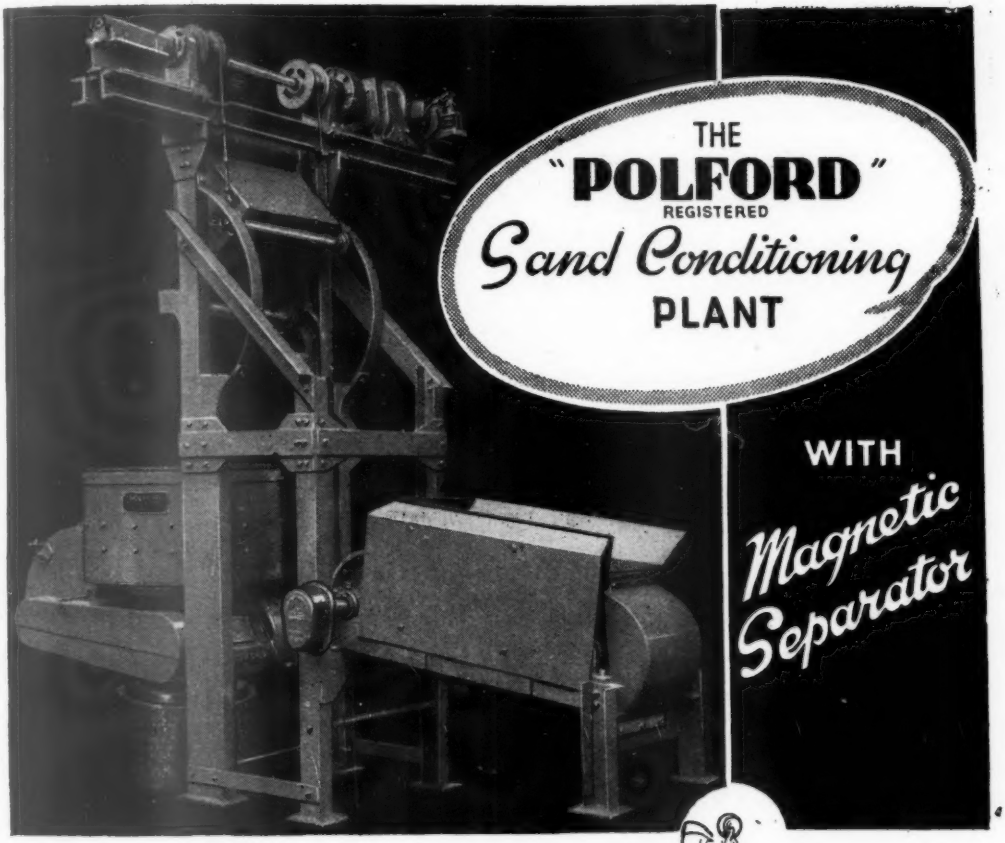
MR. FREEMAN HORN is retiring at the end of this month from his position as intelligence officer and manager of the special products department of the British Aluminium Company, Limited. His services are being retained in a consultative capacity until the end of the year. MR. L. V. CHILTON has been appointed manager of the intelligence department, and MISS W. LEWIS information officer. Responsibility for the sale of special products is being transferred to the sales division under MR. R. M. WARRINGTON, who has recently given up his position as assistant development manager to become an assistant sales manager in the sales division and to look after unwrought and special products. MR. S. F. DERBYSHIRE, manager of the alumina department of the production division, will be responsible for technical matters affecting special products.

South African Interests of Vickers and A.E.I.

Vickers, Limited, and Associated Electrical Industries, Limited, have announced that they have concluded an agreement under which they will each participate financially in Vanderbijl Engineering Corporation, Limited (Vecor), which company has large works at Vanderbijl Park, near Johannesburg, engaged in the manufacture of mechanical engineering plant and equipment. The two companies will each nominate a representative on the board of Vecor.

Associated Electrical Industries, Limited, through its subsidiary, the Metropolitan-Vickers Electrical Company, Limited, has also acquired the equity of the old-established company of L. H. Marthinusen, Limited, electrical engineers, of Johannesburg, and it has been further agreed that Vecor will acquire an interest in the last-mentioned company. The object of these arrangements, it is stated, is to assist the future development in South Africa of the mechanical and electrical engineering industries.

PAT. No. 570997



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Company News

(Figures for previous year in brackets.)

Siemens Bros. & Company—Dividend of 7½% (same).

Hale & Hale (Tipton)—Interim dividend of 5% (same).

Weyburn Engineering Company—Interim dividend of 5% (7½%).

Hammond Lane Foundry Company—Interim dividend of 3% (same).

Sheffield Forge & Rolling Mills Company—Interim dividend of 5% (nil).

Permutit Company—Dividend of 10% (same) and bonus of 2½% (same).

Gjers, Mills & Company—Final dividend of 8% (10%), making 8% (12½%).

International Diatomite Company—No dividend for the year ended March 31 (same).

Newall Engineering Company—Final dividend of 15% (20%), making 30% (same).

Harris & Sheldon—Final dividend of 7½% (same), making 10% (same). Interim dividend of 2½% (same) in respect of 1947.

Associated Clay Industries—Dividend of 15% on the 7½% preference shares in respect of the two years ended December 31, 1945.

Triplex Foundry—Net profit for the year ended March 31, after depreciation, tax, etc., £11,424 (£3,641); dividend of 7½% (5%); forward, £8,384 (£5,417).

Armstrong, Stevens & Son—Net profit to March 31, £19,293 (£14,349); to general reserve, £5,000 (£10,000); dividend of 20% (same); forward, £11,638 (£8,356).

Spear & Jackson—Net profit for 1946, after tax and depreciation, £37,350 (£33,807); to general reserve, £5,000 (same); dividend of 15% (same); forward, £12,330 (£8,730).

Rheostatic Company—Net profit to September 30, £13,493 (£9,425); dividend of 14% (12%); general reserve, £3,500 (£2,000); investments reserve, £421 (nil); forward, £5,128 (£4,999).

Tweedales & Smalley (1920)—Profit to April 30, £87,628 (£72,607); to contingencies, £100,000 (nil); final dividend of 12½%, making 17½% (same); forward, £72,040 (£127,724).

Thomas Hart—Net profit for the year ended March 31, after depreciation, taxation, etc., £3,207 (£2,320); to general reserve, £700 (£550); dividend of 12½% (10%); forward, £5,395 (£4,951).

Jury Holloware (Stevens)—Profit for the year ended March 31, after depreciation and taxation, £24,037 (£15,602); to general reserve, £10,000 (nil); dividend of 10% (same); forward, £22,900 (£21,513).

Inbucon—Net profit for the year ended March 31, after providing for tax, £32,416 (£26,953); to general reserve, £18,000 (£14,000); final dividend of 6 per cent., making 8 per cent. (same); forward, £2,554 (£1,338).

Scammell Lorries—Net profit for 1946, after depreciation, tax, etc., £51,951 (£26,T11); to preference dividend, £2,630 (nil); pensions reserve, £10,000 (nil); general reserve, £18,000 (£10,000); ordinary dividend of 10% (8½%); forward, £28,950 (£25,369).

Hallamshire Steel & File Company—Net profit to March 31, after tax, etc., £19,307 (£19,314); to depreciation, nil (£4,000); contingencies reserve, nil (£2,500); final dividend of 17½% (same), and bonus of 7½% (nil), making 32½% (25%), tax free; forward, £17,776 (£14,094).

Baker Perkins—Net profit for the 53 weeks ended December 31, after depreciation, tax, etc., £183,370 (£146,687 for previous 12 months); final dividend of 9%, making 14% (same); to general reserve, £42,166 (£25,000); pensions reserve, £5,000 (same); forward, £214,696 (£169,795).

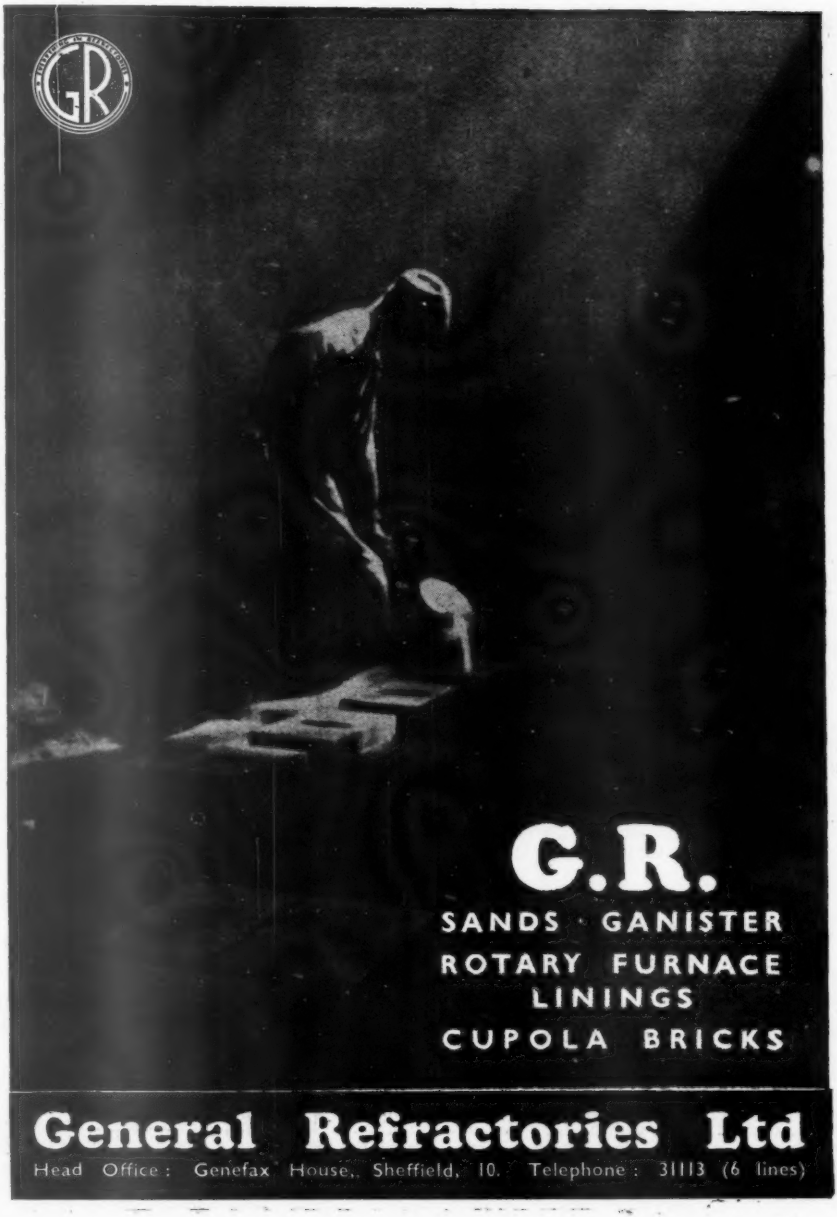
John Thompson Engineering Company—Trading loss before taxation for 1946, £23.576 (profit, £38,767); final dividend of 12½% (same) and special bonus of 5% (same), making 22½% on larger capital (22½%); to general reserve, £35,000; dividend reserve, £15,000; forward, £55,506 (£57,049).

John Harper & Company—Profit for the year ended March 30, £96,485 (£54,631); investment income, £5,566 (£1,772); to directors' fees, £1,290 (£1,185); war damage, nil (£49); tax, £54,600 (£24,699); final dividend of 17½% (11¼%), making 22½% (16¼%); further dividend of 15½% (9¼%) on employees' preference shares; forward, £41,335 (£25,892).

Cakebread, Robey & Company—Net profit for 1946, after tax, etc., £56,615 (£47,595); to general reserve, £3,000 (£10,000); deferred repairs reserve, £4,000 (£2,000); dividend equalisation reserve, £5,000 (£2,500); bad debts reserve, £1,500 (nil); income tax, £27,200 (£18,032); final dividend of 15%, making 20% (same) and bonus of 2½% (nil); forward, £18,589 (£17,611).

Harrison (Birmingham)—Profit for 1946, after expenses, tax, etc., £133,839 (£52,870); directors' fees, £500 (£850); pension fund, £500 (same); adjustments in respect of previous years, £3,126 (£790); sale of plant, £1,158 (nil); to general reserve, £35,000 (£25,000); metal stock reserve, £25,000 (nil); staff pension scheme, £15,000 (nil); preference dividend, £5,775 (£5,250); ordinary dividend of 25% (20%), tax free; profits tax, £619 (nil); forward, £124,140 (£109,661).

Harland & Wolff—Profit for 1946, £1,813,104 (£1,389,927); dividends and interest on investments, £19,020 (£15,683); profit on settlement of contracts, £79,000 (£329,000); interest to trustees of pension fund, £12,968 (£12,957); taxation, £743,958 (£675,156); depreciation, £400,000 (same); to excess cost of capital expenditure, £200,000 (same); to staff pension fund, £100,000 (same); net balance, £454,198 (£346,497); to reserve, £200,000 (£100,000); preference dividend, £64,350 (£58,500); ordinary dividend of 7% (same); forward, £16,517 (£14,748).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Raw Material Markets

Iron and Steel

Supplies of iron ore and limestone are adequate for the reduced number of furnaces now in blast, but the fuel allocation does not permit of any increase in the number of blast furnaces in operation at present. Hence the shortage of all grades of merchant iron still continues. Steel producers can take care of their own requirements, and basic-iron production has increased. But more high-phosphorus iron is badly needed in the light-castings trade, and the engineering and speciality foundries are only getting their bare minimum tonnages of hematite, low-phosphorus and refined iron, all of which are in very keen demand.

The intake of semi-finished steel from Continental sources has almost completely dried up and the tonnages coming in from the Dominions are on a smaller scale than was the case a few months ago. Shipments from the United States, however, have not entirely ceased, and there are possibilities of expansion later in the year, although negotiations are rendered more difficult by our dwindling dollar resources. Meanwhile, British makers have been able to improve their deliveries without, of course, coming within sight of full satisfaction of the requirements of the re-rolling industry. Heaviest demand is for mild-steel billets and prime steel bars.

The plate mills have far more orders than they can handle, and although some of the sheet mills are giving a hand in the rolling of the lighter gauges, there are still long waiting periods. The output of black and galvanised sheets, too, is totally inadequate, and even high-priority users have to be content with reduced quotas. In these circumstances it may seem anomalous that sheets should figure prominently in the list of steel exports, but export prices have been raised to fantastic heights, and as a matter of high policy it is not deemed advisable to impose a complete ban on overseas trade. Mills engaged on sections, channels and joists are heavily booked, and surprisingly large requisitions for colliery material have been issued by the National Coal Board. Wire drawers are as busy as ever, and tube makers could dispose of substantially increased outputs if they were more adequately supplied with strip, bars and ingots.

Non-ferrous Metals

There is little activity in the international copper market at present, and although leading producers are still quoting 21.50 cents per lb., f.a.s. New York, as a basis price, it is reported that odd lots have been offered at down at 21 cents, and in some cases, it is believed, 20.75 cents, which is equal to £115 6s. 8d. per ton.

It is reported that under an agreement reached between the British, United States and Siamese Governments, Siamese tin may in future be exported to Malaya. The agreement is understood to provide for "demarcation" tin supply areas in Siam. Tin from areas north of Tungsong and certain parts of the west coast of Siam will go to Bangkok for shipment to America, and tin from areas south of Tungsong may be exported to Malaya. The international tin market generally is somewhat dull pending details of further official allocations.

In his statement circulated with the annual report of Goodlass Wall & Lead Industries, Limited, Mr. Clive Cookson (chairman) said that while the world shortage of lead might continue for some time, the surprisingly high prices would possibly bring forward supplies which otherwise would not emerge. The shortage of lead in primary form was to some extent being made good for the time being by an increase in the volume of secondary materials available, he added. With regard to the current year, Mr. Cookson said the scarcity of lead was more acute than ever.

Contracts Open

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Cairo, September 30—Air-compressing Diesel units, accessory equipment, for the Director-General, Main Drainage Department. The Chief Inspecting Engineer, Egyptian Government, 41, Tothill Street, London, S.W.1. (Fee £E10, non-returnable.)

Ely, July 19—Construction of approx. 4,500 yds. and approx. 820 yds. of salt-glazed ware pipe sewers, and approx. 745 yds. of 6-in. cast-iron rising main, etc., for the Rural District Council. The Rural District Council Offices, Lynn Road, Ely. (Fee £5, returnable.)

Hepton, July 8—Provision and laying of about 10,400 yds. of 6-in., 4-in. and 3-in. steel and cast-iron mains, fittings, etc., for the Rural District Council. Mr. A. Brooksbank, consulting engineer, 14, The Exchange, Bradford, Yorks. (Fee £2 2s., returnable.)

Strood, July 31—Construction of approx. 17 miles of stoneware pipe sewers and 1¾ miles of spun-iron pipe sewers and rising mains, etc., for the Rural District Council. Mr. F. W. S. Stanton, consulting engineer, 5, Victoria Street, Westminster, London, S.W.1. (Fee £5, returnable.)

ALL FOUNDRIES IN Eire except two have been closed by shortage of coke.

MR. E. W. COLBECK has been appointed a director of Hadfields, Limited. He will take up his duties on July 1.

DR. HAROLD HARTLEY, technical director of Radiation, Limited, was elected president of the Institution of Gas Engineers at the recent annual meeting at Birmingham. He is president of the British Cast Iron Research Association.

MR. JOHN T. GREEN, a director of Thos. Firth & John Brown, Limited, Sheffield, and MR. J. C. LITTLE, a past-president of the Amalgamated Engineering Union, are among the members of a committee which has been set up to examine the use of man-power in the Royal Navy.